
NAS NORTH ISLAND - NAVY REGION SOUTHWEST NAVY ENVIRONMENTAL LEADERSHIP PROGRAM

CLEANUP

2-D AND 3-D HIGH-RESOLUTION SEISMIC REFLECTION SURVEYS

LEAD ACTIVITY

Naval Air Station (NAS) North Island

STATUS

Completed

MISSION

Characterize subsurface geology to determine contaminant migration pathways and contaminant hotspots

DESCRIPTION

Resolution Resources, Inc. (RRI) completed innovative site characterization of Site 9 using 2 dimensional (2-D) and 3 dimensional (3-D) high-resolution seismic imaging surveys. The technology uses the principles of seismic refraction and reflection to map subsurface lithology. The use of seismic imaging surveys can provide a better understanding of heterogeneous subsurface geology and allow more effective placement of wells for contaminant delineation and remediation, thus reducing overall project costs. The data from the seismic surveys were correlated with data collected from cone penetrometer tests, mud rotary borings, and hollow-stem auger borings to create an image of the subsurface lithology.

At Site 9, dense non-aqueous phase liquids (DNAPLs) have migrated through about 10 feet of vadose zone soils into the underlying saturated zone. The seismic and drilling data indicated that a discontinuous clay layer was present at a depth of 35 feet below ground surface (bgs) and that a continuous clay layer was present at 114 feet bgs. One purpose of the seismic surveys was to locate depressions in the continuous clay layer where DNAPLs may have collected and pooled. Wells could then be drilled into the DNAPL pools to allow removal of free DNAPLs. The seismic data, however, indicated that the clay layer may be breached by faults and may not collect DNAPLs.

To determine if DNAPL pools were present, temporary wells were drilled into three depressed areas in the continuous clay layer identified by the seismic data. These areas were thought to be the most likely areas for DNAPLs to collect if fracturing was not too extensive. However, free product was not found in any of the wells. It was concluded that the clay layer was, indeed, too fractured and faulted to hold DNAPLs, as was indicated by the seismic data.

The cost to implement 2-D and 3-D high-resolution seismic survey at NAS North Island was about \$250,000. This included a literature review, fracture trace analysis, 2-D and

3-D data collection and processing, data interpretation, and reporting. Based on the estimated cost of the original Navy characterization plan that called for 600 borings on a grid over the 40-acre site, NAS North Island estimates that use of 2-D and 3-D surveys saved the Navy several million dollars in characterization costs and will save millions of dollars more in reduced remediation costs.

In addition to characterization activities at Site 9, a 2-D base-wide seismic reflection survey was completed. This technology has been successfully exported to NAS Alameda, where it is currently being demonstrated under the Office of the Deputy Under Secretary of Defense Environmental Security's (ODUSD(ES)) Technology Certification Program. The object of the demonstration is to verify the technology's ability to image DNAPL in the subsurface.

BIBLIOGRAPHY

- **Fact Sheet:** [2D and 3D High Resolution Seismic Reflection Surveys \(NELPFS-6.PDF, 729KB\)](#)
- Naval Air Station North Island. 2-D and 3-D High Resolution Seismic Reflection Surveys at Chemical Waste Disposal Area, Site 9 Resolution Resources, Inc. March 1995.
- Jacobs Engineering Group, Inc. Remedial Investigation/RCRA Facility Investigation Report, Site 9, Naval Air Station North Island, October 1995.

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